

Docket No.: 285507US0PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:

GROUP: 1784

Tadaaki KANEKO, et al.

SERIAL NO: 10/566,652

EXAMINER: LANGMAN, JONATHAN C

FILED: June 28, 2006

FOR: TANTALUM CARBIDE, METHOD FOR PRODUCING TANTALUM
CARBIDE, TANTALUM CARBIDE WIRING AND TANTALUM CARBIDE
ELECTRODE

DECLARATION UNDER 37 C.F.R. § 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Sir:

Now comes Satoshi TORIMI who deposes and states that:

1. I am a graduate of Graduate School of Kwansei Gakuin University and received my Master degree in the year 2008.

2. I have been employed by Toyo Tanso Co. LTD for 2 years and 9 months as an assistant researcher.

3. I have reviewed and understood the Office Action dated February 18, 2011 and I have read and understood the contents of Douglass et al. (US 3,163,563), Lopez et al (US 5,916,377) and Garg et al (US 5,126,206).

4. The following experiments were carried out by me or under my direct supervision and control.

Experiment I

Two Ta base materials were subjected to thermal treatments as shown in Table I below,

Table 1.

| | Temp[°C] | Vacuum Pressure (Pa) | Period (hr) | C: Ta: O (mass%) |
|-----------------|-------------|----------------------|-------------|---------------------|
| Comp. Example 1 | 2000, 2330* | 10 | 2 | 44.25: 54.45 : 1.31 |
| Example 1 | 2000 | 10 | 2 | 19.7: 39.7: 40.85 |

2300* : the carbon penetration was conducted at 2300 °C or higher because the carbon source in Douglass was CH₄ and CH₄ was not decomposed when the temperature was not high enough, i.e. about 2300 °C.

For Comparative Example 1, carbon penetration was conducted in a condition substantially identical with the condition in Douglass where the carbon penetration was carried out without removing Ta₂O₅ formed on the surface of the tantalum substrate. For Example 1, after Ta₂O₅ formed on the surface of the tantalum substrate was removed, carbon penetration was carried out.

The surface SEM images of Comparative Example 1 and Example 1 are shown in Reference Drawing 1. In Example 1, a fibrous structure in which fibrous crystals are densely provided is observed whereas no fibrous crystals are observed in Comparative Example 1. This result clearly demonstrates that the crystal structure of the present invention is not obtained in Comparative Example 1. The crystal structure of Comparative Example 1 has poor hardness and poor frictional resistance because the crystals are sparsely provided. Additionally, an oxygen content at the surface of Comparative Example 1 indicates the presence of Ta₂O₅ and shows that Ta₂O₅ was not removed before the carbon penetration and that the purity of the tantalum carbide was low.

Experiment II

Two Ta base materials were subjected to thermal treatments as shown in Table 2 below.

Table 2.

| | Furnace Temp[°C] | Vacuum Pressure (Pa) | Period (hr) |
|-----------------|------------------|----------------------|-------------|
| Comp. Example 2 | 1850 | 10 | 2 |
| Example 2 | 2000 | 10 | 2 |

For Example 2, after Ta_2O_5 formed on the surface of the tantalum substrate was removed, carbon penetration was carried out. The tantalum carbide obtained by the carbon penetration after the removal of Ta_2O_5 has uniform thickness in depth in both TaC layer and TaC_2 layer as shown in cross-sectional optical microscope images of Example 2 below. Reference Drawing 2 contains optical microscope images of (1)(a), (1)(b), (2)(a) and 2(b) taken at various areas of Example 2 and the optical microscope images of (1)(a), (1)(b), (2)(a) and 2(b) were taken at various areas of Comparative Example 2 .

To the contrary, for Comparative Example 2, carbon penetration was carried out without removing Ta_2O_5 formed on the surface of the tantalum substrate. As shown in cross-sectional optical microscope images of Comparative Example 2 in Reference Drawing 2, the tantalum carbide forms uneven layers of Ta_2C throughout the surface of Comparative Example 2.

As is evident from the experimental results in Experiment I and II, the tantalum material obtained without removing Ta_2O_5 formed on the surface of the tantalum substrate prior to carbon penetration does **not necessarily** form a TaC layer having fibrous crystals as in the present application. In fact, in the present Experiment I and II, the tantalum material obtained without removing Ta_2O_5 formed on the surface of the tantalum substrate prior to carbon penetration did not form a TaC layer having fibrous crystals as in the present application. It is my opinion, based on the examples above and the examples of the specification, that a tantalum carbide material of the above-captioned patent application as shown in Experiment I and II should not have been foreseen based on the disclosures of the references cited.

Application No. 10/566,652
Declaration under 37 C.F.R. 1.132

5. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

6. Further deponent saith not.

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Signature

Satoshi Tordani

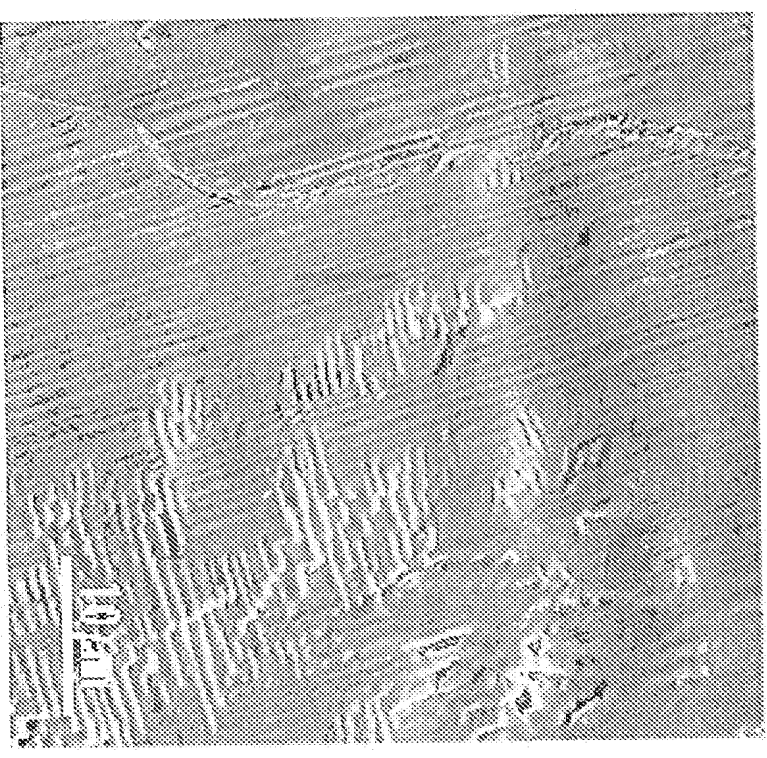
Date

6/16/2011

Comparative example 1

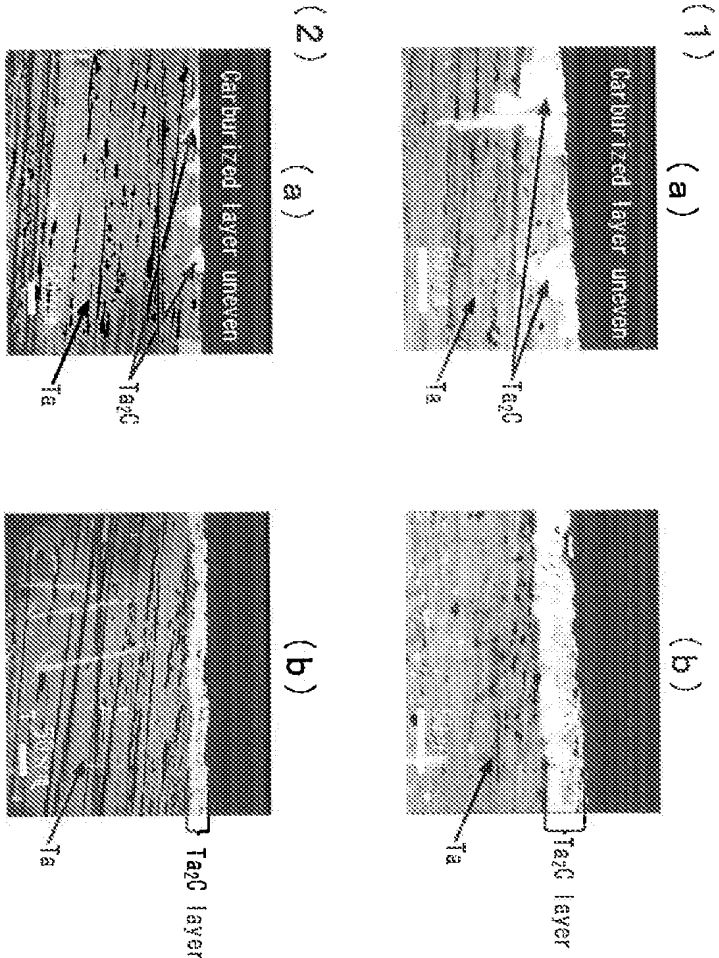


Example 1 (the present invention)

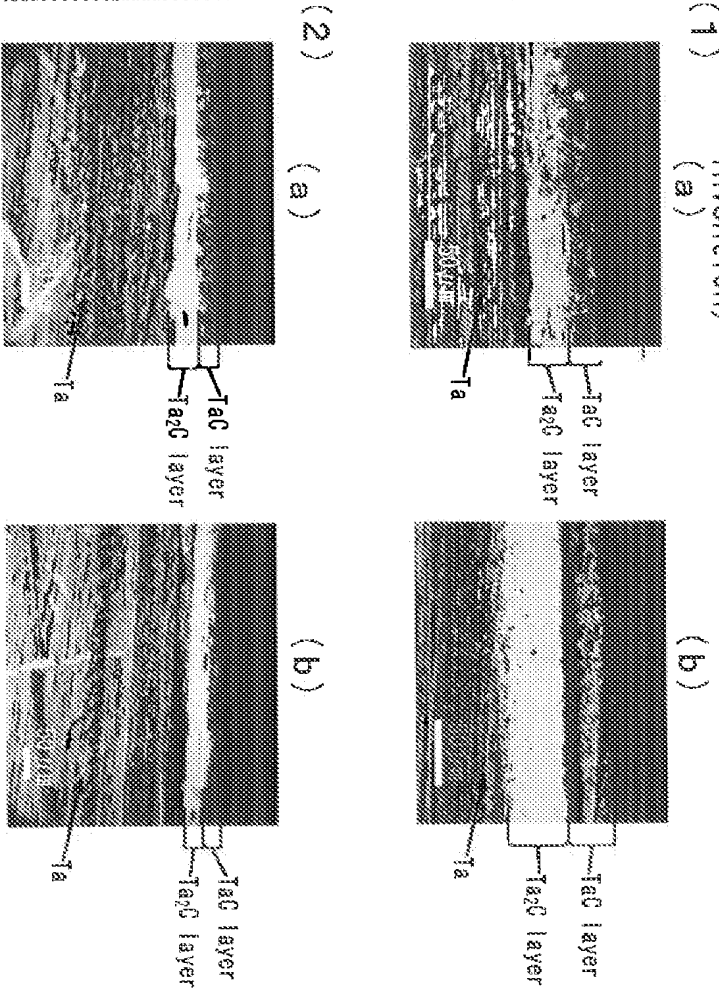


Cross-sectional optical microscope image

Comparative example 2

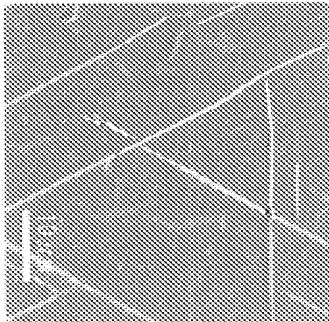


Example 2 (the present invention)



Surface SEM image

Comparative example 2



Example 2

